nKRA
Installation Guide

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IMPORTANT NOTICE

nKRA is a trademark and Sol is a registered trademark of Processor Technology Corporation.

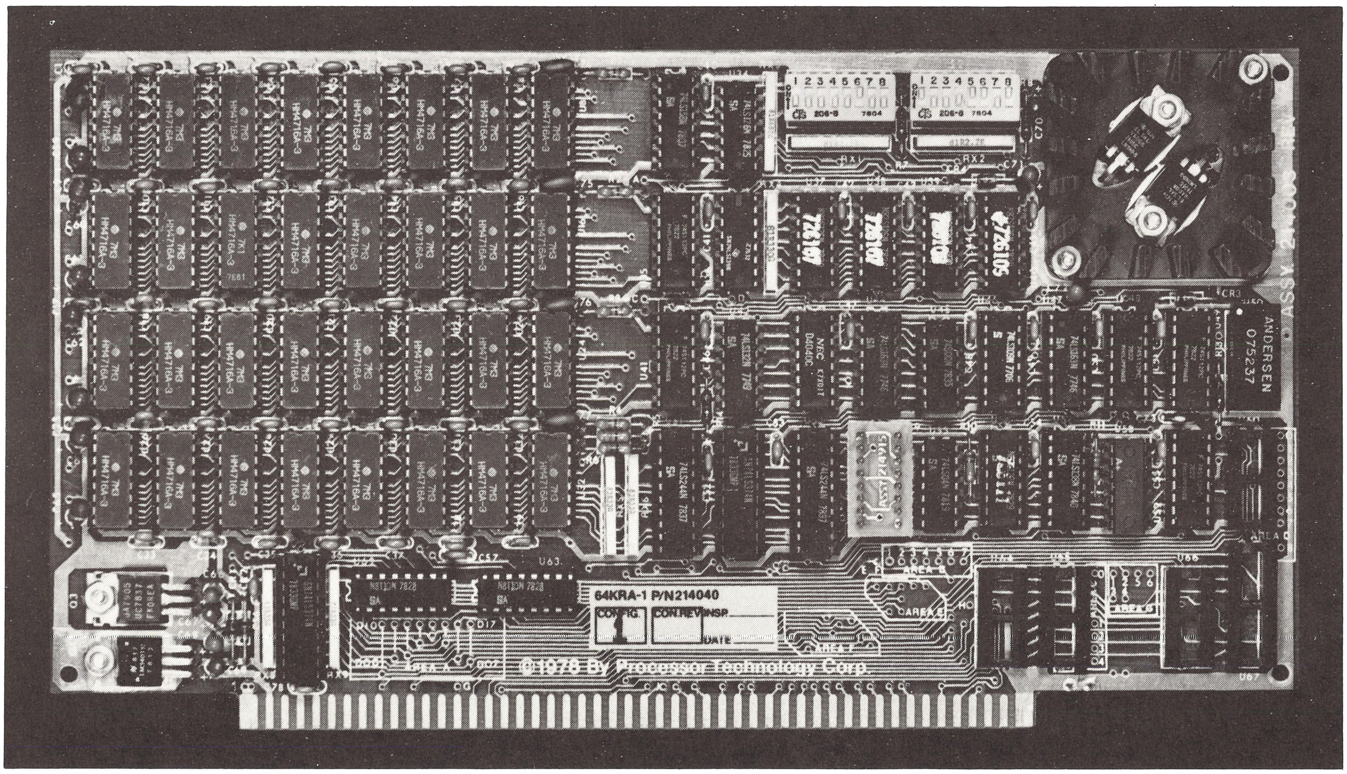
INTRODUCTION

This guide introduces you to any member of the nKRA (TM) family of memory boards. Included are a discussion of handling precautions, and instructions for unpacking and addressing the board. Do not unpack the board until you have read the instructions below.

CAUTION

> Installation of an nKRA board should be attempted only by a technically qualified person. Potentially dangerous voltages are present inside the Sol. Processor Technology dealers are authorized to install nKRA boards.

If you are interested in schematics or theory of operation, this guide is not intended for you. More technical information is available to Processor Technology dealers. Service on all Processor Technology equipment, in and out of warranty, is the responsibility of the selling dealer.



WHAT IS AN nKRA BOARD?

An nKRA board is a memory module designed for use in a Sol (R) or other 8080-based microcomputer using the S-100 bus. The difference between the four models of nKRA is that each furnishes the system with a different amount of memory; the 16KRA-1 has 16K bytes of memory (or 16 X 1024 locations), the 32KRA-1 has 32K bytes, etc. Each board has a yellow sticker identifying it by the amount of memory it contains.

The photograph depicts one of the nKRA boards, with arrows pointing out three important features:

The RAMs (Random Access Memory circuits) are arranged in rows of eight in the upper left-hand corner of the board. Each row represents a "page." On a 16KRA-1 or a 32KRA-1 board, a page consists of 8K bytes of memory; on a 48KRA-1 or a 64KRA-1 board, a page consists of 16K bytes of memory.

The Dual Inline Package (DIP) switches are located near the upper right edge of the module. Before the board is installed in the computer, these switches are used to assign a range of addresses to each page on the board. Instructions for "addressing" a board are given below.

The edge connector is the part of the board that must be inserted into the S-100 bus connector when the board is installed.

The power supply in the Sol Terminal Computer will support as many nKRA memory boards as will fit into the Sol backplane. If the total amount of memory represented by the boards is greater than 64K, however, the 8080 microprocessor will not be able to use the extra memory unless special software is added to the system. (Information about extended addressing is available to Processor Technology dealers.)

HANDLING PRECAUTIONS

The memory board and its components are delicate electronic devices. It is important to take precautions to prevent a board from being damaged during handling, installation, or removal.

1) Many of the circuits that make up the board are susceptible to even very small discharges of static electricity. (That is, if you walk across a carpeted room and give the board a shock, some of the circuits might be damaged.) Handle the board in such a way that no discharge flows through the circuits from your body or from tools:

    a. Wear cotton clothing, rather than synthetics, when you handle the board. Always touch some other object to discharge static electricity from your body before touching the board. A good object to touch is one that is is made of conductive material (for example, metal) and is either in direct contact with the earth or plugged into the wall with a three-pronged plug. When installing the board or removing it from the computer, touch the computer chassis before touching the board.

b. Avoid handling the module unnecessarily. When you must handle it, i.e., when you are unpacking, installing, addressing, or removing it, hold it around the edges, as you would a photograph. (Not only will such handling minimize the risk of damage to the board, but it will prevent you from pricking yourself on the "pins" that stick through the board.)

c. When the board is outside the computer, keep it wrapped in an anti-static bag like the one in which it was shipped.

2) Dangerous voltages are present inside the computer, so always turn the computer off and unplug it before you remove its cover. If you neglect this precaution, you risk harm to the board, to the computer, and to yourself.

3) Follow instructions carefully when you install the board, and DO NOT INSTALL IT UPSIDE DOWN. Damage will be caused to the computer or the board if the latter is not inserted component side up when power is applied.

UNPACKING THE BOARD

Follow this procedure to unpack the board:

1) Examine the shipping container for signs of possible damage during transit. If the container is damaged, do not open it; instead, contact the carrier (and your dealer, if you are not the dealer) immediately.

2) Carefully open the container and withdraw the memory board. Do not sink a knife blade more than 1/8" into the container.

3) Save the shipping materials, in case the board has to be returned to the dealer or to the factory.

4) Before removing the board from its anti-static covering, discharge any static electricity from your body.

5) Inspect the board for obvious physical damage. Make sure that all of the circuits (the rectangular components seated in plastic sockets) are inserted completely in their sockets: using your fingers, apply moderate pressure to each circuit. If the circuit does not slip farther into its socket, it is already fully seated. You will notice several empty sockets on the board. Those sockets are supposed to be empty; they are associated with optional circuitry not implemented on the board.

6) If the board is damaged, contact the carrier (and your dealer, if you are not the dealer) immediately, describing the condition of both the shipping container and its contents.

HOW TO ADDRESS THE BOARD

An address is simply a number that identifies a location in memory; when you address a board, i.e., assign a range of addresses to each page, you enable the board to recognize any references that are made to it while the computer is in operation.

If the board will reside in a Sol System and all of the memory boards in that system are nKRA's, the figure opposite this page shows you how to set the DIP switches near the upper right corner of each board. Just find the label for the appropriate combination of boards, and set the switches as shown in the figure. (If the black mark is in the upper half of a given switch, set the switch in the UP position; if the black mark is in the lower half of a switch, set the switch in the DOWN position; if there is no black mark, it does not matter how you set the switch.) The switch settings given are only one example of the possible switch settings for any combination of boards. In each case, settings represent continuous addresses from 0 to the total amount of memory represented by the boards; for example, the sample switch settings given for a system with one 32KRA-1 board and one 16KRA-1 board represent 48K of memory, beginning at 0.

If the system already contains one or more nKRA boards, remove them from the system so that you can use the figure to address all of memory at once. You can tell which boards are nKRA's by the identifying stickers and by the position of the DIP switches.

Once you have set the DIP switches according to the figure, you are ready to install the board; unless you are interested in more information about addressing, you can skip to the section entitled, "A Note about Installation."

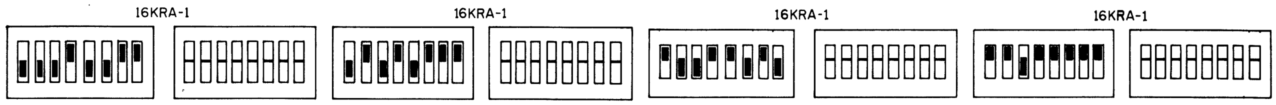
If the board will not reside in a Sol System, or if the system includes memory boards that are not nKRA's, do not use the figure; instead, read the discussion below and use the Addressing Table in this guide to determine the proper switch settings for the nKRA board.

The first step in addressing a board is to decide what range of addresses to assign to each page. There are a number of factors to consider when making your decision:

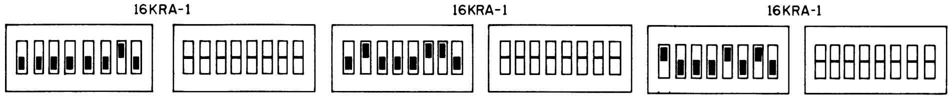
1) The starting address for a page may be any non-negative multiple of 4096 decimal (or 1000 hexadecimal) that is less than 65536 decimal (or 10000 hexadecimal). The first column in the Addressing Table is a list of all available starting addresses.

2) The ending address for a page on a 16KRA-1 or 32KRA-1 board will be the starting address plus 8191 decimal (1FFF hexadecimal); the ending address for a page on a 48KRA-1 or 64KRA-1 board will be a starting address plus 16383 decimal (3FFF hexadecimal). If the starting address assigned is less than a page away from address 65535 decimal (FFFF hexadecimal), the assignment of addresses to the page will proceed as though memory were circular, i.e., the addresses assigned after 65535 will be consecutive addresses beginning at 0.

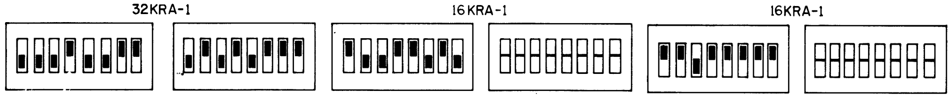
FOUR 16KRA-1 BOARDS



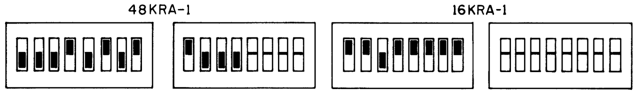
THREE 16KRA-1 BOARDS



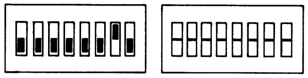
ONE 32KRA-1 BOARD & TWO 16KRA-1 BOARDS



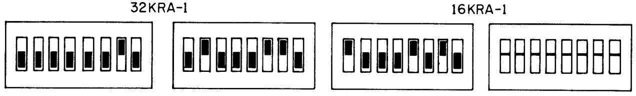
ONE 48KRA-1 BOARD & ONE 16KRA-1 BOARD



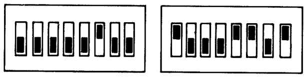
ONE 16KRA-1 BOARD



ONE 32KRA-1 BOARD & ONE 16KRA-1 BOARD



ONE 64KRA-1 BOARD

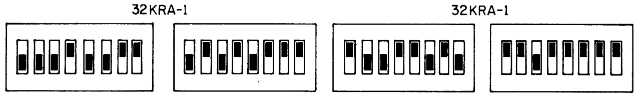


▀ Switch is in the UP position

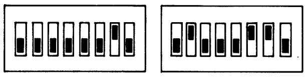
▄ Switch is in the DOWN position

☐ Switch setting may be either UP or DOWN

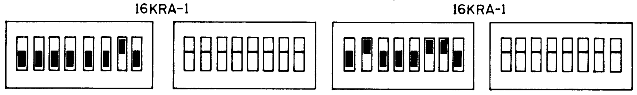
TWO 32KRA-1 BOARDS



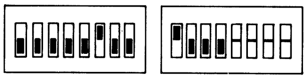
ONE 32KRA-1 BOARD



TWO 16KRA-1 BOARDS



ONE 48KRA-1 BOARD



3) Pages on a board will overlap if the starting addresses assigned to them are less than a page apart: for example, if one 8K page has a starting address of 0 and the next has a starting address of 4096, addresses 4096 to 8191 will be represented on both pages. It is permissible to assign overlapping addresses to pages on the same memory board; the result of such an assignment is that one page is actually used to represent the addresses, and any overlapping pages or portions of pages are disabled. Do not assign any of the same addresses to two or more boards in the same system; determine what addresses have been assigned to the boards already in your system before you decide how to address an additional board. (If your computer is a Sol, do not assign addresses 49152 to 53247 decimal - C000 to CFFF hexadecimal; those addresses are occupied by the SOLOS operating system and the memory for the video display.) Assign overlapping addresses on a single board, if necessary, in order to avoid duplicating addresses assigned elsewhere in your system.

4) It is usual to address a board in such a way that the memory represented is continuous; for example, a 16KRA-1 board might represent addresses according to the following scheme:

	Decimal	Hexadecimal
page 1	0 to 8191	0 to 1FFF
page 2	8192 to 16383	2000 to 3FFF

A 48KRA-1 board added to the same system might then be addressed:

	Decimal	Hexadecimal
page 1	16384 to 32767	4000 to 7FFF
page 2	32768 to 49151	8000 to BFFF
page 3	32768 to 49151	8000 to BFFF

Remember that each page on a 48KRA-1 board consists of 16K bytes, and notice that two of the pages on the board have been overlapped in order not to occupy addresses assigned to SOLOS.

This combination of switch settings is not the best choice for these two boards, because although 64K of memory is available to the system, no memory is addressed to represent locations in the 12K of memory between 53248 and 65535 decimal (D000 to FFFF hexadecimal). If you changed the addressing of page 3 of the 48K board so that it began at D000, it would overlap page 1 of the 16K board and so violate the rule against assigning the same addresses to two or more boards in a system. A change in the addressing of one page on each board results in a more efficient setting of the address switches:

16KRA-1 board	Decimal	Hexadecimal
page 1	4096 to 12287	1000 to 2FFF
page 2	8192 to 16383	2000 to 3FFF

48KRA-1 board	Decimal	Hexadecimal
page 1	16384 to 32767	4000 to 7FFF
page 2	32768 to 49151	8000 to BFFF
page 3	53248 to 4095	D000 to 0FFF

Notice that the overlap is now between the two pages of the 16KRA-1 board.

5) Most software requires that you have memory at particular addresses, even if the result is that the memory in your system is not continuous. Memory requirements are generally described in the manuals you receive with the software. If you have a Sol System III or IV, the minimum memory requirement is 48K addressed continuously beginning at 0.

Once you have decided what addresses to assign to each page, consult the Addressing Table to find the corresponding DIP switch settings. Locate the two DIP switches on the board; each consists of eight small switches. The first four small switches in the first group (from left to right) on the board determine the addresses assigned to the first page (top row of circuits), the second four apply to the second page (second row of circuits), and so on. If the board has fewer than four pages, the settings of the extra switches have no effect.

ADDRESSING TABLE

STARTING ADDRESS		DIP SWITCH SETTINGS			
Decimal	Hexadecimal				
0	0000	0	0	0	0
4096	1000	0	0	0	1
8192	2000	0	0	1	0
12288	3000	0	0	1	1
16384	4000	0	1	0	0
20480	5000	0	1	0	1
24576	6000	0	1	1	0
28672	7000	0	1	1	1
32768	8000	1	0	0	0
36864	9000	1	0	0	1
40960	A000	1	0	1	0
45056	B000	1	0	1	1
49152	C000	1	1	0	0
53248	D000	1	1	0	1
57344	E000	1	1	1	0
61440	F000	1	1	1	1

Look at the columns marked DIP SWITCH SETTINGS in the table. The zeros and ones specify how the four little switches representing a page are to be set: 0 means that the switch should be in the DOWN (or OFF) position, and 1 means that the switch should be in the UP (or ON) position. For example, if you wanted to give a page a range of addresses beginning at 45056 decimal, all but the second of the switches representing that page would have to be in the UP position.

EXAMPLE: For continuous memory from 0000 to 7FFF hexadecimal, the switch settings on a 32KRA-1 board would be:

Page 1	Page 2	Page 3	Page 4
0 0 0 0	0 0 1 0	0 1 0 0	0 1 1 0

A NOTE ABOUT INSTALLATION

Detailed instructions for installing a board are included in the section entitled "Installation of S-100 Modules" in the Sol User's Manual, Second Edition. If the computer is not a Sol, ask a Processor Technology dealer to ascertain whether nKRA boards are compatible with the system.

CAUTION

Installation of an nKRA board should be attempted only by a technically qualified person. Potentially dangerous voltages are present inside the Sol. Processor Technology dealers are authorized to install nKRA boards.

SPECIFICATIONS

The following information might be required by a dealer or technician who services the board.

CAPACITY (8-bit bytes):

16KRA-1	16,384
32KRA-1	32,768
48KRA-1	49,152
64KRA-1	65,536

OPERATING MODE: Dynamic

REFRESH: Invisible

DMA CAPACITY: Yes

ACCESS AND CYCLE TIME: 400 nsec access worst case
487 nsec min cycle

WAIT STATES: None required

ADDRESS SELECTION: 4096-byte pages addressable with dual inline switches

POWER REQUIREMENTS: +8 to +10 VDC @ 1.0A maximum, unregulated
+15 to +19 VDC @ 150mA maximum, unregulated
-15 to -19 VDC @ 50mA maximum, unregulated

Specifications are subject to change without notice.